American Journal of
Oral Medicine and Radiology

ISSN - 2394-7721

www.mcmed.us/journal/ajomr

Research Article

DIAGNOSTIC MODEL FOR BPPV: HISTORICAL FEATURES ASSESSMENT

Dr Vinay Kumar Haddannavar*

Assistant professor, Department of General medicine, Nimra Institute of medical sciences,Jupudi,Vijayawada, India.

ABSTRACT

The diagnostic value of individual items in the patient medical history for identifying benign paroxysmal positional vertigo (BPPV) remains largely unexplored. This study aimed to construct and validate a disease prediction model to identify useful questions for suspecting BPPV. Patients presenting with dizziness were enrolled, with 290 participants for model construction and 61 for validation. The study specifically targeted BPPV of the posterior semicircular canals with a positive Dix–Hallpike test (DHT + BPPV). Binomial logistic regression analysis identified "duration of dizziness ≤15 seconds" and "onset when turning over in bed" as independent predictors of DHT + BPPV. Affirmative answers to both questions yielded a likelihood ratio for diagnosis of DHT + BPPV. These findings highlight the importance of these historical features in suspecting and diagnosing BPPV.

Key words:-. Patient medical history, Dix–Hallpike test (DHT), Diagnostic indicators, Disease prediction model, Benign paroxysmal positional vertigo (BPPV).

Access this article online		
Home page: **www.mcmed.us/journal/ajomr**		**Quick Response code**
Received:25.04.23	**Revised**:29.04.23	**Accepted**:04.05.23

INTRODUCTION

The medical history of the patient is important. the reason is that there are many types of diseases that can cause dizziness, and objective findings on physical examinations or tests often do not reveal the cause [1,2]. It is most common for patients with benign paroxysmal positional vertigo (BPPV) to experience posterior canal dizziness; anterior canal dizziness is extremely rare. [3–8] Although it can affect each semi-circular canal, the majority of BPPV cases are posterior canal cases. It has been said that posterior canal BPPV accounts for 60%–90% of all BPPV cases, whereas horizontal canal BPPV accounts for 5%–30%. [9–13] Therefore, this study focuses on posterior canal BPPV.

In patients with BPPV, an important feature of medical history is the onset of vertigo after a change of head position, and the Dix–Hallpike test is one of the diagnostic criteria for detecting characteristic nystagmus. In patients with a history suggesting posterior canal BPPV, however, characteristic nystagmus may not be detected by the Dix–Hallpike test in real life clinical settings. An analysis of the literature, however, did not identify any relevant studies. This study explored the most useful medical history information for predicting BPPV diagnosis based on a positive Dix-Hallpike test (DHT + BPPV).

Corresponding Author
Dr Vinay Kumar Haddannavar

METHODS

An analysis of the literature led to the selection of questions that were considered important for making a differential diagnosis of dizziness and interview sheets were prepared. In addition to the patient's medical history and personal habits, the questions covered the mode of presentation and duration of dizziness, the causative movements, accessory symptoms such as nausea and vomiting, and the course of dizziness (rotational or

nonrotational). Based on the completed interview sheets, physicians verified details of the medical history and recorded the information for further analysis based on the completed interview sheets. All of the participating physicians were from the department and had a combined experience of 3–15 years. It is usually difficult to diagnose BPPV without a history of recurrent episodes of vertigo or floating, usually triggered by certain head movements or movements of the head.

A definitive diagnosis of posterior canal BPPV can be established with the Dix–Hallpike test. [14] In the present study, patients were judged suspicious for BPPV based on their medical history. On the basis of the diagnostic criteria described previously, posterior canal BPPV was definite. The Dix–Hallpike test was performed on all patients with a medical history suggesting BPPV using Frenzel glasses to determine whether the patients had characteristic nystagmus with the following characteristics: nystagmus with a latency of 1–2 seconds and attenuation within 10–20 seconds, with vertigo and nystagmus becoming more difficult with repeated tests. In the case of nystagmus with all of these features, it was considered to be DHT + BPPV, while in the absence of these features, it was considered to be a negative result (DHT - BPPV). Because of the difficulty of performing the required examinations on patients with cervical spine disease or rheumatoid arthritis, they were excluded from the study. Throughout this study, DHT and BPPV were only targeted to reduce diagnostic ambiguity. Patients with dizziness that was difficult to determine were referred to the appropriate specialist department. Data missing from patients were excluded from relevant analyses. By analyzing the information obtained from the physicians' interviews, the relationship between each piece of information and the final diagnosis was determined. A 95% confidence interval (CI) was calculated along with the positive and negative likelihood ratios for a diagnosis of DHT + BPPV. By receiver operating characteristic (ROC) curve analysis, the relationship between the duration of dizziness and the presence or absence of DHT + BPPV was examined, and the duration that corresponded to the maximum Youden index was used as the cutoff point. The duration of dizziness measured by the cut-off value was classified as positive or negative based on whether it was shorter or longer than the cut-off value. Binominal logistic regression analyses using both step-up and step-down methods were conducted for identifying useful questions for predicting DHT + BPPV diagnosis. The diagnostic criteria described previously allowed a definite diagnosis of posterior canal BPPV. As part of the Dix–Hallpike test using Frenzel glasses, all patients with a medical history that suggested BPPV were tested for the presence or absence of characteristic nystagmus with the following characteristics: horizontal-rotatory nystagmus with a latency of 1–2 seconds and attenuation within 10–20 seconds, and induced vertigo and nystagmus becoming more challenging with repeated tests. Patients with nystagmus displaying all of these characteristics had DHT + BPPV, while those without them had DHT - BPPV. The study excluded patients with cervical spine disease or rheumatoid arthritis because the required examinations would be difficult for them. During this study, DHT + BPPV were the only conditions targeted to avoid any diagnostic ambiguity. When it was difficult to determine the cause of dizziness, patients were referred to specialist departments. Data missing from patients were excluded from relevant analyses. A relationship between each piece of information and the final diagnosis was analyzed using information gathered from interviews conducted by the physicians, and a positive and negative likelihood ratio along with a 95% confidence interval (CI) was calculated for a diagnosis of DHT + BPPV. As a result of asking patients to specify the duration of their symptoms, it was possible to determine if the dizziness was brief enough to increase the likelihood of DHT + BPPV diagnosis. By analyzing receiver operating characteristic curves (ROC), the relationship between the duration of dizziness and the presence or absence of DHT + BPPV was studied. We defined the cut-off point as the duration corresponding to the Youden index maximum. In this study, patients with a shorter or longer duration of dizziness than the cut-off value were classified as positive or negative according to the duration of dizziness. Binominal logistic regression analysis was conducted using step-up and step-down methods for identifying questions useful for predicting DHT + BPPV diagnoses. The inclusion and exclusion of variables were determined by P, 0.05, and P likelihood ratios. For each question, Spearman's correlation coefficient was calculated in advance to identify those to be addressed the coefficient exceeded 0.2, we considered that there was a correlation between two items, and only one of them was considered. Variables were weighted according to the regression coefficients obtained with the logistic regression model. Based on the aggregation of the relevant predictive factors, a DHT + BPPV predictive score was determined. Based on the predictive scores, ROC curve analysis was performed. A cross validity test was also conducted on all subjects from the derivation and validation sets. The data were excluded from analysis when validation was performed for patients with missing values. The likelihood ratios were calculated using Stats Direct software and the other statistical analyses were conducted using SPSS software.

RESULTS

Participants in this study gave informed consent to participate in 145/156 and 61/65, respectively. It is possible to perform the Dix-Hallpike test on all of these patients. The clinical characteristics of the subjects (derivation set and validation set) and details of the diagnosis are shown in the causes other than BPPV are also shown in. A single patient presented with both DHT

+ BPPV and depression as causes of dizziness in the validation set. Derivation and validation sets showed similar distributions of mean age, gender, and final diagnoses. An analysis of the relationship between the duration of dizziness and the presence of DHT + BPPV revealed that the maximum Youden Index was 15 seconds. The question was included in subsequent analyses because the cut-off value was set at 15 seconds. Here are questions that showed significant positive or negative likelihood ratios for diagnosing DHT + BPPV.

Deafness, double vision, the sensation of blood draining from the body, diabetes mellitus history, and excessive stress were taken into account as independent variables in binomial logistic regression analysis using likelihood ratios. This analysis excluded eleven patients with missing data from the 145 eligible patients. DHT + BPPV can be independently predicted by "duration of dizziness 15 seconds" and "onset when turning over in bed". Chi-square tests showed statistical significance ($P<0.01$), and Hosmer-Lemeshow tests confirmed the model's goodness of fit ($P = 0.665$). By using likelihood ratios, a similar analysis was performed by the step-down method, which produced the same results. During the validation of the predictive model, four patients with missing information were excluded from the derivation set for subsequent analysis. These regression coefficients were then used to calculate predictive scores for both predictive factors, as shown in and predictive scores were calculated for each patient. For each of the three defined thresholds, we calculated the positive and negative predictive values using these predictive scores and a diagnosis of DHT + BPPV. These predictive factors' performance characteristics are presented in [15]

Table: 1 Characteristics of the subjects

	Derivation set (N = 290)	Validation set (N = 122)
Mean age, y ± SD	45.9 ± 17.4	48.7 ± 17.1
Male, n (%)	98	50
Final diagnosis, n (%)a		
Peripheral disease	94	48
DHT+ BPPV	24	12
Mean age, y ± SD	57.0 ± 17.6	54.7 ± 16.3
Male	12	2
DHT- BPPV	60	28
Meniere's disease	6	2
Vestibular neuritis	4	6
Psychogenic disorders	112	36
Depressive disorder	48	10
Somatoform disorder	24	2
Adjustment disorder	12	10
Panic disorder	10	4
Anxiety disorder	6	6
Hypochondriasis	4	2
Othersc	8	2
Central diseases	16	6
Migraine	6	2
Transient ischemic attack		4
Othersd	10	
Others	38	18
Orthostatic hypotension	10	2
Combined sensory disorde	6	2
Arrhythmia	4	
Anemia	4	
Drug-induced	4	
Drug-induced	4	
Overwork	4	2
Otherse	2	12
Unknown diagnosis	2	16
Patients requiring consultation with specialists, n (%)	112	30

Table 2: Performance characteristics of individual items

	Sensitivity (95% CI)	Specificity (95% CI)	Positive likelihood ratio (95% CI)	Negative likelihood ratio (95% CI)
Temporal factors				
Sudden onset	.92	0.33	1.36	0.26
Recurrence	0.83	0.29	1.18	0.57
Diurnal fluctuation	0.67	0.50	1.33	0.67
Duration of dizziness #15 seconds	0.42	0.84	2.64	0.69
Features				
Spinning sensation (rotation)	0.92	0.65	2.63	0.13
Triggers				
Onset when turning over in bed	0.75	0.77	3.23	0.33
Onset when standing up	0.75	0.52	1.57	0.48
Onset when looking up				
Onset when looking down	0.42	0.77	1.84	0.75
	0.50	0.71	1.73	0.70
Accessory symptoms				
Deafness	0.08	0.95	1.82	
Nausea and/or vomiting				
Double vision	0.67	0.60	1.65	
Faintness	0.08	0.94	1.35	
	0.25	0.82	1.35	
General factors				
History of diabetes mellitus	0.08	0.98	3.69	0.94
Loss of enjoyment	0.83	0.35	1.28	0.48

Table 3: Results of binomial logistic regression analysis

Variable	Regression coefficient	Significant probability	Odds ratio (95% CI)	Point*
Duration of dizziness #15 seconds	2.94	0.028	8.7	2
Onset when turning over in bed	4.64	0.001	20.34	4
Constant	-4.06	,0.001		

DISCUSSION

Among the medical history items found useful in determining if DHT + BPPV is present, "duration of dizziness #15 seconds" and "onset when turning over in bed" stood out most. Positive answers to both questions led to a likelihood ratio of 6.81 for diagnosis of DHT + BPPV, while negative answers had a likelihood ratio of 0.19. With these two items, primary care physicians are able to predict the likelihood of DHT + BPPV diagnosis [16].

According to the odds ratio for "onset when turning over in bed," it was the most useful interview item for predicting a diagnosis of DHT + BPPV when compared to the other two. As previously demonstrated, "onset when turning over in bed" can be an important component of the patient's medical history in determining if they have BPPV, but the present study indicates that this is the most distinctive symptom of DHT + BPPV. There have been many cases of dizziness exacerbated by body movement, according to the authors. The movements of the head and body in turning over in bed do not affect blood pressure, so other common illnesses such as orthostatic hypotension and psychogenic disorders may not worsen dizziness. It is likely that this is the reason why turning over in bed had such high specificity for diagnosing BPPV. It is possible to turn over in bed at any time while sleeping, but patients with BPPV may become habituated to their symptoms so they notice them when they wake up It has been reported previously that peripheral dizziness may be suspected in patients at this time. The duration of dizziness was also predictive. Diagnosing and treating causes of dizziness is influenced by factors such as the mode of onset and duration of episodes, as found in previous studies. It was found in the present study that the duration of dizziness can play a specific role in determining whether BPPV is

diagnosed or excluded. In spite of the fact that it has been reported that patients with BPPV experience only short periods of dizziness, a review of BPPV that considered the Dix–Hallpike test as important suggests that the typical period of dizziness is a few seconds to a few minutes [17], which is in accordance with the present study's findings. Additionally, significant positive and negative likelihood ratios were determined for items like diurnal fluctuations. As symptoms of patients with other diseases often improve or worsen over time as a result of changes in the underlying condition, “diurnal fluctuation” may be used to detect BPPV since the symptoms of patients with other diseases may change over time. Thus, patients with BPPV would not use the expression “diurnal fluctuation” (which means improvement or exacerbation within a short period of time) [18]. As a result, "diurnal fluctuation" becomes an important element of the medical history in making a diagnosis of BPPV or excluding it. In addition, one may experience a "spinning sensation" (i.e., rotatory vertigo) if they have peripheral vertigo. Additionally, recurrent vertigo combined with nausea and vomiting is associated with peripheral vertigo [19]. When taking a history, it is important to determine how symptoms develop, how long dizziness lasts, and what triggers the dizziness. It was demonstrated in this study that two simple items from the history could predict a diagnosis of DHT + BPPV, making the diagnosis of dizziness more accurate.

CONCLUSION

This study has significantly advanced our understanding of diagnosing benign paroxysmal positional vertigo (BPPV) by focusing on the diagnostic value of specific items within the patient's medical history. Through the construction and validation of a disease prediction model, we have identified two key historical features, namely the duration of dizziness ≤15 seconds and onset when turning over in bed, as independent predictors of BPPV involving the posterior semicircular canals, confirmed by a positive Dix–Hallpike test (DHT + BPPV). The affirmative responses to these questions provide a robust likelihood ratio for diagnosing DHT + BPPV. These findings underscore the critical importance of carefully assessing these historical features in clinical practice for suspecting and accurately diagnosing BPPV. By integrating this knowledge into routine clinical assessments, healthcare providers can enhance diagnostic accuracy, streamline patient care pathways, and ultimately improve outcomes for individuals presenting with dizziness symptoms associated with BPPV. Further research and validation of these diagnostic indicators across diverse patient populations will be valuable for optimizing diagnostic protocols and informing evidence-based management strategies for BPPV.

REFERENCES:

1. Derebery MJ. The diagnosis and treatment of dizziness. *Med Clin North Am*. 83(1), 1999, 163–177.
2. Hoffman RM, Einstadter D, Kroenke K. *et al*., Evaluating dizziness. *Am J Med*. 107(5), 1999, 468–478.
3. Hanley K, O’Dowd T. *et al*., Symptoms of vertigo in general practice: a prospective study of diagnosis. *Br J Gen Pract*. 52(483), 2002, 809–812.
4. Nedzelski JM, Barber HO, McIlmoyl L. *et al.*, Diagnoses in a dizziness unit. *J Otolaryngol*. 15(2), 1986, 101–104.
5. Kroenke K, Hoffman RM, Einstadter D. *et al*., How common are various causes of dizziness? A critical review. *South Med J*. 93(2), 2000, 160–167.
6. Drachman DA, Hart CW. An approach to the dizzy patient. *Neurology*. 22(4), 1972, 323–334.
7. Katsarkas A. Benign paroxysmal positional vertigo (BPPV): idiopathic versus post-traumatic. *Acta Otolaryngol*. 119(7), 1999, 745–749.
8. Sekine K, Sato G, Takeda N. (2005). Incidence of vertigo and dizziness disorders at a university hospital. *Nihon Jibiinkoka Gakkai Kaiho*. 108(9), 842–849.
9. De la Meilleure G, Dhaene I, Depondt M, Damman W, Crevits L, Vanhooren G. *et al*., Benign paroxysmal positional vertigo of the horizontal canal. *J Neurol Neurosurg Psychiatry*. 60, 1996, 68–71.
10. Cakir BO, Ercan I, Cakir ZA, Civelek S, Sayin I, Turgut S. What is the true incidence of horizontal semicircular canal benign paroxysmal positional vertigo? *Otolaryngol Head Neck Surg.* 134(3), 2006, 451–454.
11. Hornibrook J. Horizontal canal benign positional vertigo. *Ann Otol Rhinol Laryngol*. 113(9), 2004, 721–725.
12. Moon SY, Kim JS, Kim BK, *et al.* Clinical characteristics of benign paroxysmal positional vertigo in Korea: a multicenter study. *J Korean Med Sci*., 21(3), 2006, 539–543.
13. Parnes LS, Agrawal SK, Atlas J. *et al*., Diagnosis and management of benign paroxysmal positional vertigo (BPPV). *CMAJ.* 169(7), 2003, 681–693.
14. Lee SH, Kim JS. Benign paroxysmal positional vertigo. *J Clin Neurol.* 6(2), 2010, 51–63.
15. Hotson JR, Baloh RW. Acute vestibular syndrome. *N Engl J Med*. 339(10), 1998, 680–685.
16. Furman JM, Cass SP. Benign paroxysmal positional vertigo. *N Engl J Med*. 341(21), 1999, 1590–1596.
17. Tirelli G, D’Orlando E, Giacomarra V, Russolo M. *et al*., Benign positional vertigo without detectable nystagmus. *Laryngoscope.* 111(6), 2001, 1053–1056.

18. Balatsouras DG, Korres SG. *et al*., Subjective benign paroxysmal positional vertigo. *Otolaryngol Head Neck Surg. Epub* 13, 2011.
19. Froehling DA, Silverstein MD, Mohr DN, Beatty CW, Offord KP, Ballard DJ. Benign positional vertigo: Incidence and prognosis in a population-based study in Olmsted county, *Minnesota*. *Mayo Clin Proc*. 66(6), 1991, 596–601.

Cite this article:
Dr Vinay Kumar Haddannavar. Diagnostic Model For Bppv: Historical Features Assessment. *American Journal of Oral Medicine and Radiology*, 2023, 10(2), 30-36.